

WHAT IS CLAIMED IS:

1. An alignment apparatus comprising:
 - a structure to be aligned;
 - a moving member which moves to align said
 - 5 structure; and
 - an electromagnetic mechanism which
 - electromagnetically applies a force between said
 - structure and said moving member to allow said
 - structure to move along with movement of said moving
 - 10 member while forming a gap between said structure and
 - said moving member,
 - said electromagnetic mechanism having
 - a first electromagnetic actuator which is
 - feedback-controlled on the basis of a deviation between
 - 15 a target position and an actual position of said
 - structure, and
 - a second electromagnetic actuator which is
 - feedforward-controlled on the basis of the target
 - position of said structure, and
 - 20 each of the first and second electromagnetic
 - actuators having
 - a pair of electromagnets which are so arranged as
 - to generate forces in opposite directions on the same
 - line, and
 - 25 a pair of targets which are arranged to face the
 - pair of electromagnets,
 - wherein an attractive force by a magnetic flux

generated by the electromagnet acts on the target between the electromagnet and the target.

2. The apparatus according to claim 1, wherein at least one target is so arranged as to be shared between
5 at least two electromagnets.

3. The apparatus according to claim 1, wherein in feedback control, a current supplied to a coil of the electromagnet is controlled in accordance with a value calculated by multiplying a square root of a force to
10 be generated by the first electromagnetic actuator in order to reduce the deviation, by a correction term corresponding to a gap between the electromagnet and the target in the first electromagnetic actuator.

4. The apparatus according to claim 1, wherein in
15 feedforward control, the target position of said structure is converted into a command value for a magnetic flux to be generated by the electromagnet of the second electromagnetic actuator, and the electromagnet is controlled on the basis of a
20 difference between the command value and a value of a magnetic flux generated by the electromagnet.

5. The apparatus according to claim 1, wherein when one of the pair of electromagnets is driven, the other electromagnet is not driven.

25 6. The apparatus according to claim 1, wherein the apparatus further comprises two first electromagnetic actuators, and the second electromagnetic actuator is

interposed between the two first electromagnetic actuators.

7. The apparatus according to claim 1, wherein a line of force generated by the second electromagnetic actuator coincides with a line passing through a barycenter of said structure.

8. The apparatus according to claim 1, wherein a gap between the first electromagnetic actuator and the target is not less than a gap between the second electromagnetic actuator and the target.

9. The apparatus according to claim 1, wherein the apparatus further comprises two driving mechanisms which are arranged at two ends of said moving member to drive said moving member, and said two driving mechanisms drive said moving member by a thrust distributed in accordance with a position of said structure.

10. The apparatus according to claim 9, wherein the thrust is so distributed as to cancel a moment of a force around a barycenter of said moving member that is generated by a reaction force applied from said structure to said moving member.

11. The apparatus according to claim 10, wherein the thrust is distributed on the basis of a barycentric position of an integral structure of said structure and said moving member.

12. The apparatus according to claim 10, wherein the

thrust is distributed on the basis of a barycentric position of said structure and a barycentric position of said moving member.

13. An exposure apparatus which uses an alignment
5 apparatus defined in claim 1 to align a target object, and executes exposure operation.

14. A device manufacturing method comprising steps
of, by using an exposure apparatus defined in claim 13:
transferring a pattern onto a substrate; and
10 developing the substrate.